CLAIMS

1   1.   In a service-provider network comprising a plurality of interconnected provider

2   edge routers and transit routers, a router comprising circuitry that:

3   A)   receives from a source not in the service-provider network packets that in-

4   clude destination-address fields that specify final destinations that also are

5   not located in the service-provider network;

6   B)   for each of a plurality of such received packets:

7   i)   makes a routing decision based not only on the contents of that

8   packet's destination-address field but also on the source from

9   which it receives that packet;

10   ii)   inserts into the packet an internal-routing field, determined at least

11   in part in accordance with the source from which the edge router

12   received the packet, that specifies a route to an interface on another

13   of the provider edge routers; and

14   iii)   forwards the resultant packet to another router in the service-

15   provider network in accordance with the routing decision; and

16   C)   receives, from other routers in the service- provider network, packets that

17   include internal-routing fields and destination-address fields and:

18   i)   forwards some such packets without their internal-routing fields to

19   routers, not located in the service-provider network, that it selects

20   in accordance with a routing decision based on the contents of the

21   packets' internal-routing fields; and

22   ii)   for other such packets, makes routing decisions based on the con-

23   tents of those packets' internal-routing fields without reference to

24   those of their destination-address fields, and, in accordance with

25   those routing decisions, forwards those packets to other routers in

26   the service-provider network.

2.   A router as defined in claim 1 that:

    A)   makes routing decisions based on the contents of reachability messages that it receives;

    B)   is connected to at least first and second pluralities of customer routers, with which it respectively associates first and second VPN IDs;

    C)   when it receives a reachability message concerning a given network-address range from a customer router with which it associates a given VPN ID, sends a reachability message concerning the combination of that network-address range and the given VPN ID to each router in the service-provider network that is connected to a customer router associates with the same VPN ID; and

    D)   when it receives a reachability message concerning the combination of a network-address range and a given VPN ID associated with a customer router to which it is connected, it sends that customer router a reachability message concerning that network-address range.

3.   A router as defined in claim 2 that uses an external gateway protocol to send other routers in the service-provider network the reachability message concerning the combination of network-address range and the given VPN ID.

4.   A router as defined in claim 3 wherein the external gateway protocol that the router uses to send other routers in the service-provider network the reachability message concerning the combination of network-address range and the given VPN ID is the Border Gateway Protocol.

5.   A router as defined in claim 2 wherein:

    A)   the internal-routing field includes both an egress-router field and an egress-channel field;

    B)   the router bases its routing decisions concerning the packets that it forwards without reference to their destination-address fields on the internal-

6   routing fields' egress-router fields without reference to their egress-

7   channel fields; and

8   C)   the router bases its selections of the routers not located in the service-

9   provider network to which it forwards packets containing internal-routing

10   fields on the internal-routing fields' egress-channel fields.

1   6.   A router as defined in claim 5 that maintains an information base that associates

2   internal-routing-field contents with routers to which it is connected in the service-

3   provider network and forwards packets containing internal-routing fields to the routers

4   with which the information base associates the contents of those internal-routing fields.

1   7.   A router as defined in claim 6 wherein:

2   A)   the information base associates at least certain internal-routing-field con-

3   tents with replacement internal-routing-field contents, and

4   B)   the router replaces the certain internal-routing-field contents with the re-

5   placement internal-routing-field contents in packets that it forwards.

1   8.   A router as defined in claim 7 that replaces internal-routing-field contents re-

2   places the contents of some packets' egress-router fields without replacing the contents of

3   their egress-channel fields.